SECTION 5

CALIBRATION

5.0 GENERAL

This procedure is supplied to allow service personnel to perform an instrument alignment using a minimum of test equipment. This procedure is not intended to replace a complete instrument checkout and alignment as performed at the Corometrics factory.It should be considered a performance check and troubleshooting guide to be used in conjunction with other information supplied throughout this service manual.

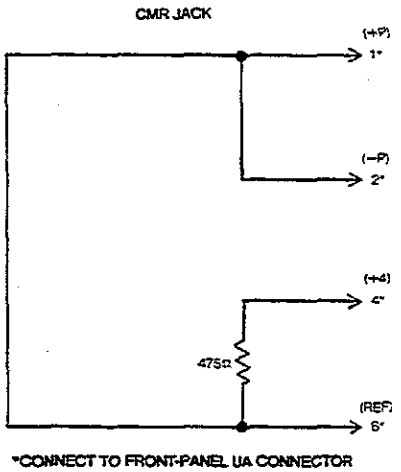
The electronic calibration procedures outlined in this section necessitate removal of the Model 115 Fetal Monitor's top cover. Also, the following equipment will be needed in order to carry out the procedural steps:

- Digital Voltmeter, Fluke 8020A or equivalent
- Plastic alignment tool
- Oscilloscope
- Frequency Counter
- 305 Simulator or (306 Simulator) with 115 adapter cables
- 2 Clip-type jumper cables
- US Extender Cable (Part No. 6027A)
- 2 Card Extenders (Part No. 5792B)
- Pressure Zero CMR Jack (see FIGURE 5-1)
- 2 mV Test Jack (see FIGURE 5-1)
- Ultrasound Load Jack (see FIGURE 5-1)

NOTE: Read each instruction carefully and thoroughly before executing the procedural step.

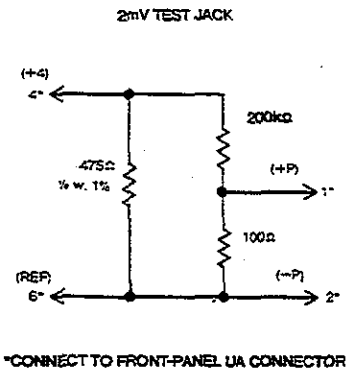
5.1 INITIAL SETUP

1. Ensure Power switch on front panel is not depressed.
2. Connect the Model 115 Fetal Monitor's power cord to the J101 power receptacle on unit's rear panel. Next, plug power cord into a properly grounded AC electrical outlet.
3. Power-up the monitor by depressing the Power switch. Next verify that:
   a) the green LED indicator to the right of the Power pushbutton illuminates.
   b) the amber LED indicator to right of Record button illuminates for approximately 3 seconds.
   c) the HR display on the monitor's front panel reads all eights ("888"), the heart symbol illuminates continuously, and the UA display reads "+188" for approximately 3 seconds, and then the display goes blank.



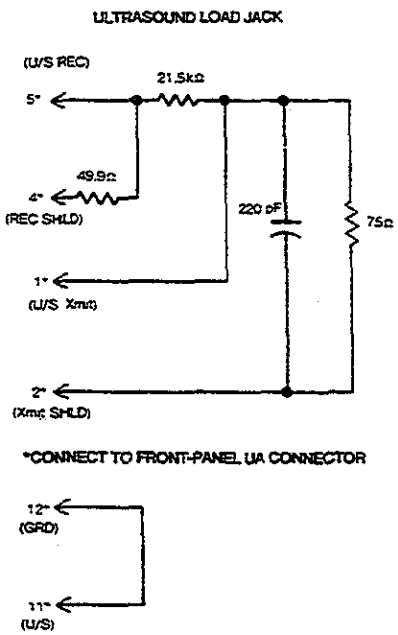
CMR JACK

Description	Part Number
Pressure Connector	6158J
475 Ω res. 1/8 W 1%	472127



2 mV TEST JACK

Description	Part Number
Pressure Connector	6158J
475 Ω res. 1/8 W 1%	472127
200 kΩ res. 1/8 W 1%	472037
100 Ω res. 1/8 W 1%	472210



ULTRASOUND LOAD JACK

Description	Part Number
US Connector	6158G
21.5 kΩ res. 1/8 W 1%	472025
49.9 Ω res. 1/8 W 1%	472000
75 Ω res. 1/8 W 1%	472142
220 pF cap.	150068

CALIBRATION TEST JACKS
FIGURE 5-1

5.2 5804 POWER SUPPLY ADJUSTMENTS

1. Measure the voltages on the 5804 Power Supply Board using a digital voltmeter and compare the results to TABLE 5-1. There are no adjustments for these measurements.

LOCATION (T.P.)	VOLTAGE (V)	RIPPLE
+15 V to GND	+14.25 to +15.75	10 mV p-p
−15 V to GND	−14.25 to −15.75	10 mV p-p
+12 V to GND	+11.4 to +12.6	1.5 V p-p
+22 V to GND	+18 to +26	1.0 V p-p

5804 POWER SUPPLY VOLTAGE
TABLE 5-1

2. Using a digital voltmeter, adjust R3 until the voltage at the +5 V test point is equal to +5.10 V.
3. Using a digital voltmeter, adjust R4 until the voltage at the V HEAD test point measures within ± 100 mV of the value stamped on the recorder assembly in the upper right corner.

5.3 5800 MULTIFUNCTION BOARD PRESSURE ADJUSTMENTS

1. Connect the 305 Simulator to AC Line Power. If using the 306 Simulator, connect the 24-pin connector from the 306 Simulator to the J102 connector on the rear panel of the Model 115 Monitor.
2. Connect the Pressure Input Connector from the 305 Simulator (or 306 Simulator) to the UA input receptacle on the monitor. Set the Uterine Activity Main switch on the 305 Simulator (or the Uterine Activity Mode switch on the 306 Simulator) to the CMR position.
3. Use a digital voltmeter to adjust R58 until the voltage at TP4 is equal to +4.0 V ±2 mV.
4. Use a digital voltmeter to verify that the voltage at TP7 is equal to +10.0 V ± 20 mV.

NOTE: There is no adjustment for this voltage.

5. Remove the 305 Simulator (or 306 Simulator) and install a pressure CMR Jack. Use a digital voltmeter to adjust R33, offset, until the voltage at TP5 is equal to +1.0 V ± 5 mV.
6. Remove the pressure CMR Jack and install the 2 mV Test Jack into the UA input receptacle on the Model 115 Fetal Monitor.
7. Use a digital voltmeter to adjust R57, GAIN, until voltage at TP5 is equal to +3.00 V ± 5 mV.
8. Remove the 2 mV Test Jack and reinstall the Pressure Input Connector from the 305 Simulator (or 306 Simulator).
9. Use a frequency counter to adjust R34, FREQ ADJ, until the frequency at TP6 is equal to 3.264 kHz ± 30 Hz.

5.4 5800 MULTIFUNCTION BOARD US ADJUSTMENTS

1. Turn off the Model 115 Fetal Monitor and remove the 5800 Multifunction Board. Install the Card Extenders in the card cage and place the PCB onto the Card Extenders. Then use the US transmit and extender cables to reconnect the two coaxial cables.
2. Turn on the monitor and connect the US Load Jack to the PHONO/ULTRASOUND input connector.
3. Use an oscilloscope to adjust L10 until the voltage at TP12, XMIT is +4.0 V ± 0.1 V p-p.
4. Use a frequency counter to adjust C91 until the frequency value at TP12, XMIT, is equal to 2.3 MHz ± 5 Hz.
5. Monitor TP9, Rx, with an oscilloscope. Connect the scope ground lead to the receive connector P15 shell. Adjust L7, until the peak-to-peak voltage at TP9 reaches its maximum value.
6. Remove the US Load Jack, turn off the monitor, and reinstall the 5800 Multifunction Board into the card cage.

5.5 5806 ECG 1 ADJUSTMENTS

1. Turn on the Model 115 Fetal Monitor and use a digital voltmeter to measure the isolated power supply voltages on the 5806 ECG 1 PCB. Compare the readings with TABLE 5-2. There are no adjustments for any of these voltages. Keep in mind that TP13 is an isolated power supply ground. The voltage difference between these two power supplies should not exceed 1.0 V.

LOCATION	VOLTAGE
TP11 to TP13	+10.0 V ± 1 V
TP12 to TP13	−10.0 V ± 1 V

5806 ECG 1 PCB POWER SUPPLY VOLTAGES
TABLE 5-2

2. Use a clip-type jumper cable to connect the junction of R54, R55, and Q4 (collector end) to TP2 (ground). Use another clip-type jumper cable to connect TP2 to TP5.
3. Use a digital voltmeter to adjust R1 until the voltage at TP7 is equal to 0.00 V ± 20 mV.
4. Remove the clip lead from TP5 and connect it to TP3. Adjust R36 until the voltage at TP1 is equal to 0.00 V ± 20 mV.
5. Remove both clip-type jumpers from the test points inside the monitor.

5.6 5802 OR 6802 CPU ADJUSTMENTS

1. Use the 305 Simulator (or 306 Simulator) to attach the FECG and PRESSURE connectors to the FECG and UA input receptacles on the Model 115 Fetal Monitor.
2. Set the 305 Simulator controls to those shown in TABLE 5-3. (If using the 306 Simulator, set the controls to those in TABLE 5-4.)
3. Adjust the MANUAL ADJUSTMENT control on the 305 Simulator (or RATE (BPM) control on 306 Simulator) until a heart rate of 120 BPM is achieved and appears on the LED display.
4. Use a digital voltmeter to adjust R55, ZERO, until the voltage at TP9, HR1, is equal to 0.00 V ± 10 mV.
5. Adjust the MANUAL ADJUSTMENT control on the 305 Simulator (or the RATE (BPM) control on the 306 Simulator) until a heart rate value of 180 BPM is achieved on the LED display.
6. Use a digital voltmeter to adjust R53, GAIN, until the voltage at TP9, HR1, is equal to +600 mV ± 10 mV.

CONTROL	SETTING
MAIN ECG	LEFT POSITION
RATE bpm	MANUAL
ECG MODE	FECG
QRS AMPLITUDE μV	100 μV
MAIN UA	LEFT POSITION
UA MODE	TOCO
LEVEL mmHg	MANUAL
MANUAL ADJUSTMENT	FULLY COUNTERCLOCKWISE

305 SIMULATOR CONTROL SETTINGS
TABLE 5-3

7. Adjust the MANUAL ADJUSTMENT control on the 305 Simulator (or RATE (BPM) control on the 306 Simulator) until a heart rate value of 60 BPM appears on the LED display. Verify that the voltage at TP9, HR1, is equal to −600 mV ± 10 mV. For single-cardiotach monitors, skip steps 8 and 9.

8. On dual-cardiotach monitors only, use the 305 Simulator (or 306 Simulator) to input an FECG rate of 120 BPM. Once the display reads 120 BPM ± 1 BPM, connect the US Load Jack and adjust R99, ZERO, until the voltage at TP5, HR2 is equal to 0.00 V ± .005 V.

9. On dual-cardiotach monitors only, disconnect the US Load Jack and adjust FECG rate to 240 BPM. When display reads 240 BPM, reconnect the US Load Jack and adjust R100, GAIN, until the voltage at TP5, HR2 is equal to 1.2 V ± .005 V.

10. Depress the monitor's front panel UA REFERENCE button and then the RECORD button.

11. Verify the UTERINE ACTIVITY pressure baseline to be at 10 mmHg. Adjust the MANUAL ADJUSTMENT control on the 305 Simulator (or the LEVEL (mm-Hg) control on the 306 Simulator) until a pressure reading of 50 mmHg is achieved on the digital display and chart recorder.

12. Use a digital voltmeter to adjust R56, ZERO, until voltage at TP8, UA, is equal to 0.00 V ± 10 mV.

13. Adjust the MANUAL ADJUSTMENT control on the 305 Simulator (or the LEVEL (mm-Hg) control on 306 Simulator) until a pressure reading of 100 mmHg is achieved on the digital display and chart recorder.

14. Use a digital voltmeter to adjust R54, GAIN, until voltage at TP8, UA, is equal to +1.20 V ± 10 mV.

15. Adjust the 305 Simulator's MANUAL ADJUSTMENT control (or the 306 Simulator's LEVEL (mm-Hg) control) until a pressure reading of 25 mmHg is achieved. Verify that the voltage at TP8, UA, is equal to −600 mV ± 10 mV.

NOTE: In order to perform the next steps, the monitor must be connected to AC line voltage and have been in a power-on mode for 24 hours.

16. Adjust potentiometer R39 fully clockwise and monitor the voltage at TP6. Next, turn off the unit by depressing the Power pushbutton on the monitor's front panel. Verify that the voltage at TP6 exceeds +3.85 VDC and record the reading.

17. While the monitor is still in power off mode, use a scope and counter to verify that the signal at TP7 is 32.768 kHz ± .001 kHz at a peak-to-peak voltage of no less than .5 volts of the voltage recorded at TP6.

CONTROL	SETTING
FETAL RATE MODE	MANUAL
SIGNAL MODE	INT. ECG
FECG GAIN-POLARITY	FULLY COUNTERCLOCKWISE
RATE (BPM)	0 BPM
UTERINE ACTIVITY MODE	LEVEL (mm-Hg)
LEVEL (mm-Hg)	0 mm-Hg

306 SIMULATOR CONTROL SETTINGS
TABLE 5-4

5.7 RECORDER BOARD PAPER-LOW/PAPER-OUT ADJUSTMENTS

There are two different calibration procedures depending upon Recorder Board. Refer to TABLE 5-5 to determine which calibration procedure should be followed.

PROCEDURE A (This letter revision board and lower.)	PROCEDURE B (This letter revision board and higher.)
5808X	6709A
6808H	6808J
6665E	6665F
6666D	6666E

RECORDER BOARDS
TABLE 5-5

PROCEDURE A

The following adjustment procedures for PAPER-LOW and PAPER-OUT apply to the Recorder Boards shown in TABLE 5-5 and subsequent boards with lower letters, found in Model 115 Fetal Monitors.

Paper Low Adjustments

1. Extend the 5808 Recorder Board from the monitor. Apply power to the monitor.
2. Install the last four (4) sheets of chart paper with black dots and run recorder at 1 cm/min. Adjust R30 until the voltage at TP11 [or U18 (pin 10) on Recorder Boards with "AA" artwork fabs] is between 3.80 V and 3.90 V. This adjustment must be made while the black dot on the recorder paper is directly in front of the paper-low sensor.
3. Place white paper (not black dots) in the recorder and adjust R30 until the voltage at TP11 [or U18 (pin 10) on Recorder Boards with "AA" artwork fabs] is less than 0.3 V.
4. Repeat steps 2 and 3 above to ensure that specifications are met.
5. Run recorder at 1 cm/min with white paper installed. Verify that the LED indicator to the right of the front-panel RECORD button does not flash. Verify that the LED indicator does flash when the first black dot is directly in front of the paper-low optosensor.
6. Remove chart paper and close recorder drawer.

Paper Out Adjustments

1. Adjust R29 until the voltage at the paper-out test point (see TABLE 5-6) is between 3.80 V and 3.90 V.

RECORDER BOARD ARTWORK FABS	TEST POINT
AA	U18 (pin 5)
BA	TP1
CA	TP13
DA	TP13

PAPER-OUT TEST POINT
TABLE 5-6

2. Install white chart paper and close recorder drawer and power up the monitor.
3. Adjust R29 until the voltage at the power-out test point (see TABLE 5-6) is less than .3 V. This adjustment must be made with white paper (no black dots).
4. Repeat steps 1 through 3 to ensure that specifications are met.
5. Verify that the recorder remains activated while paper advances through the recorder. Verify that when paper runs out recorder shuts off and cannot be reactivated.

PROCEDURE B

The following adjustment procedures for PAPER-LOW and PAPER-OUT apply to the Recorder Boards shown in TABLE 5-5 and subsequent boards with higher letters, found in Model 115 Fetal Monitors.

Paper-Low Adjustments

1. Confirm the voltage at P19-22 to be from +1.1 VDC to +1.8 VDC. Record the reading.
2. Install two sheets of chart paper with black squares on the border. Run recorder at 1 cm/min and scope TP11. Stop the recorder when TP11 reaches its highest positive rise, and use a digital voltmeter to adjust R1 to +4.54 VDC ± 50 mV.
3. Place white paper (no black squares) in the recorder and confirm that the voltage at TP11 is less than +2.60 VDC. Record the reading.
4. Install two sheets of chart paper with black squares on the border and run recorder at high speed. Observe that the amber record LED begins to flash before two black squares pass the opto-sensor. Ensure that the voltage reading at TP11 is greater than +3.9 VDC for at least 5 seconds. Turn off recorder and record reading.

Paper-Out Adjustments

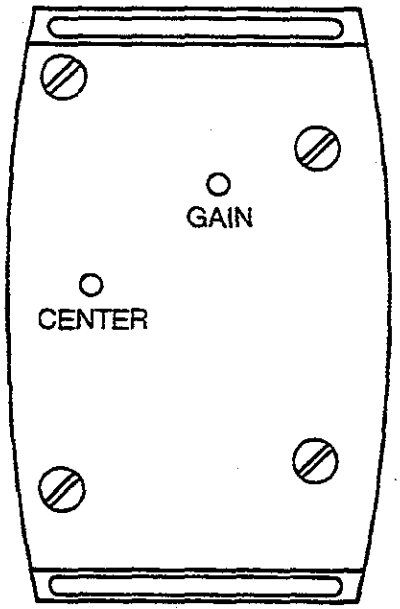
1. Confirm voltage to P19-18 is between +1.1 VDC and +1.8 VDC. Record reading.
2. Place end of chart paper over recorder's roller (approximately 1/2 inch) and close recorder drawer.

NOTE: Ensure chart paper is above paper-out optosensor when closing recorder door.

3. Use a digital voltmeter to adjust R2 for +4.54 VDC ± 50 mV at TP13 (PAPER-OUT) and record.
4. Install two sheets of chart paper and close recorder drawer. The voltage should be less than +2.60 VDC. Run paper to end of last sheet, observing that the amber record LED goes out and the recorder stops before last sheet drops out. Record results.
5. Depress Record pushbutton, observing that amber record LED lights. Open recorder drawer and verify that TP13 is greater than +4.90 VDC. Ensure that the amber record LED goes out, and the recorder stops advancing paper and cannot be activated. Close recorder drawer and record findings.

5.8 TOCOTRANSDUCER CALIBRATION (SMALL BUTTON, 5884A)

1. Insure the pressure channel is calibrated as outlined in SECTION 5.3.
2. Check plunger height. The top of the plunger should be within ± 0.015 inch from the bottom of a straightedge laid atop of the toco cover.
3. Remove the toco top cover and locate the "CENTER" and "GAIN" potentiometers. (Refer to FIGURE 5-2.)
4. Set the CENTER pot to mid-range (ten turns from one end).
5. With the toco facing upward and a digital voltmeter connected to TP5 on the 5800 Board, adjust the CENTER pot for a reading of +0.50 ± .01 VDC (0 mmHg).
6. Place a 62.5 gm weight (50 mmHg) on the plunger and adjust GAIN pot for +1.50 ± .02 VDC. Remove the weight and observe that voltage returns to +0.50 ± .01 VDC. Repeat the test to check for tracking.
7. Apply a small amount of Torque Seal to the pots.
8. Install cover on toco and tighten all four screws.



SMALL-BUTTON TOCOTRANSDUCER
FIGURE 5-2

9. With toco facing upward and voltmeter still connected to TP5, verify the voltage to be +0.50 ± .2 VDC. Place a 62.5 gm weight on plunger and observe that the voltage increases 1.00 ± .04 VDC above previous reading. Remove the weight. The voltage reading should return to its previous level within ± 20mV. Repeat the test to check for tracking.
10. To complete tocotransducer calibration, install nameplate and repeat step 9.

NOTE: Small-button transducers are referenced by the following drawing numbers:

D5884TAB:	Final Assembly
C5794B:	PCB Assembly
B5794BC:	Schematic

5.9 TOCOTRANSDUCER CALIBRATION (LARGE BUTTON)

Calibration Procedure

The following steps outline the calibration procedure for the large-button tocotransducer; a 52.5 gram weight (P/N 7825AA) and replacement sealing tape (P/N 7730AA) are required.

1. Insure the pressure channel is calibrated as outlined in SECTION 5.3.
2. Connect the tocotransducer to the Model 115 Fetal Monitor.
3. Remove the toco nameplate, top cover, and waterproof sealing tape. The sealing tape lines the area beneath the top cover.

   NOTE: Insure that replacement sealing tape is available.
4. Locate the "GAIN" (R3), "ZERO CENTER" (R1), and "ZERO TRIM" (R2) potentiometers. (Refer to FIGURE 5-3).
5. Rotate the GAIN (R3) and ZERO TRIM (R2) potentiometers fully counterclockwise.

6. Connect a digital voltmeter between TP5 (5800 Board) and ground (US receiver shield). With the toco facing upward, place the 52.5 gram weight on the plunger and adjust the ZERO CENTER (R1) potentiometer for a reading of 1.1 ± .1 V.

7. Adjust the ZERO TRIM (R2) potentiometer until the voltage at TP5 reads 1.0 ± .05 V.

8. Remove the 52.5 gram weight and adjust the GAIN (R3) potentiometer until the voltage at TP5 (5800 Board) reads .475 ± .05 V.

9. Repeat steps 6, 7, 8 as necessary to meet specifications.

10. Apply a small amount of torque seal to all potentiometers.

11. To complete tocotransducer calibration, affix replacement sealing tape, install top cover, and replace nameplate.

Calibration Check

Follow the steps below to check if the large-button tocotransducer is properly calibrated; a 52.5 gram weight (P/N 7825AA) is required.

1. Insure the pressure channel is calibrated as outlined in SECTION 5.3.

2. Connect the tocotransducer to the Model 115 Fetal Monitor.

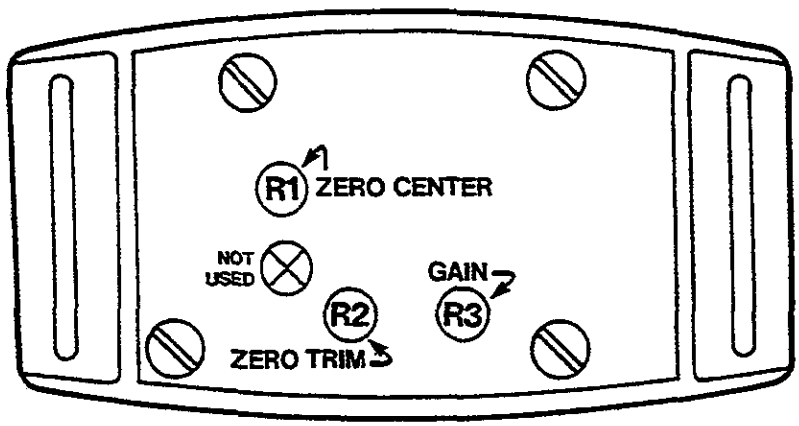
3. Place the tocotransducer plunger side up on a flat surface. Measure the voltage between TP5 (5800 Board) and ground (US receiver shield). This voltage should be 0.475 ± .1 V.

4. Place the 52.5 gram weight on the toco plunger and verify that the voltage at TP5 (5800 Board) is 1.0 ± .05 V.

5. Remove the 52.5 gram weight and insure that the voltage reading at TP5 (5800 Board) returns to .475 ± .1 V.

NOTE: Drawings in reference to the large-button tocotransducer are the following:

D7456TAB:	Final Assembly
C5794C:	PCB Assembly
C5794CC:	Schematic



LARGE-BUTTON TOCOTRANSDUCER
FIGURE 5-3